

Personal Identification Based on Finger Vein Recognition System

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Abstract: In this project, we propose an embedded finger-vein recognition system (FVRS) for authentication. The system is implemented on an embedded Arduino Uno platform and equipped with a novel finger-vein recognition algorithm. The proposed system consists of hardware modules. CMOS JPEG camera job is to capture finger vein images and send to main embedded platform. SD card reader job is to store images in standard jpeg format so that further process is done at ease. Our finger vein matching scheme can run on application MATLAB program to check whether finger vein matches with dataset.

Keywords: Finger Vein Capture Module, Controller Board and Image Acquisition.

I. INTRODUCTION

Today, security is very much essential in all kind of activities. Illegal activities are happening in every place today. So government and corporate sections are concentrating mainly on the security levels with their every invention. This will bring privacy all over the world. So in a thought of bringing privacy through security level, this project has been developed. This FVR system mainly uses three divisions which are image acquisition module, embedded main board, and human machine communication module. Each unit is having its own major role over the project. In this paper, two major areas have been focused. Those are authentication and identification. FVR system performs the authentication function with the finger vein recognition. Every time when the user is going to use the system, the finger vein of will be scanned and comparison will be done. Finger vein recognition is very effective when compared with pattern recognition, pin number security the other type of Biometric security methods like finger print security, palm print security, image scanning and some recognition techniques.

FVR system uses the vein scanning. As it is related to the biological factor, it is very difficult to change the vein information of a user. So, this system can provide more security than any other security level. The finger-vein is a promising biometric pattern for personal identification in terms of its security and convenience. Compared with other biometric traits, the finger-vein has the following advantages:

- The vein is hidden inside the body and is mostly invisible to human eyes, so it is difficult to forge or steal.

- The non-invasive and contactless capture of finger-veins ensures both convenience and hygiene for the user, and is thus more acceptable.
- The finger -vein pattern can only be taken from a live body. Therefore, it is a natural and convincing proof that the subject whose finger-vein is successfully captured is alive.

II. RELATED WORK

In this section, we review the prior work on finger vein biometric security system over various applications. David et al[1] introduced preliminary process to enhance the image quality that worsen by light effect and produces noise by the web camera, then segmented the vein pattern by using adaptive threshold method and matched them using improved template matching. The result shows that even the image quality is not good and as long as the veins are clear with some appropriate process can be used for personal identification. Wenming et al [2] proposed a structured personal identification approach using finger vein Location and Direction Coding (LDC). Initially finger vein imaging device is designed using Near-InfraRed (NIR) light source, by which a database for finger vein images is established. The brightness difference in the finger vein image is used to extract the vein pattern. Then finger vein LDC creates a structured feature image for each finger vein. The structured feature image is utilized to conduct the personal identification with image database for finger vein, which includes 440 vein images from 220 different fingers.

Hua-Bin et al [3] presented an algorithm based on adaptive filtering and retinex method for enhancement of hand vein images. The principal of the near-infrared

hand vein image acquisition is introduced, then the retinex method is used to normalize hand vein images, and the adaptive smoothing method is selected to estimate the illumination. Then the gray cosine transform is used to enhance the discrimination of the skin and the vein in hand vein images. Then a determination criterion of hand vein is established to remove the false vein blocks from the segmented hand vein images. Desong et al [4] presented a more secure and reliable user identification mechanism using biometrics technology equipped into the consumer electronics devices. The system uses finger-vein identification system which provides high security and reliability than other identification technology. The algorithm composes of a feature extraction using radon transform and singular value decomposition and classification using a normalized distance measure.

III. PROPOSED SYSTEM DETAILS

Finger vein recognition is a method of biometric authentication that uses pattern-recognition techniques based on images of human finger vein patterns beneath the skin's surface by connecting strong LED source with one switch. Block diagram of this system is as shown in Fig.4. Finger vein recognition is one of many forms of biometrics used to identify individuals and verify their identity. Since this finger vein capture CMOS camera is serial communication supported we can easily integrated to any device or micro controller. This finger vein module CMOS camera directly gives the data of finger vein and will be analyzed using MATLAB-DIP. Here, the data regarding particular person will be compared with the Details of the person already in the MATLAB dataset. Finally, after processing this will give message dialog box to show whether it is authorized or non-authorized. When we keep our finger between LED source and CMOS camera and switch is pressed, the IR rays will be emitting from the Infrared LED are emerged through the finger. Then these rays are captured by the CMOS camera. These rays will be formed such that the veins of our finger can be visible very closely. This image can be extracted at the system of finger vein pattern extractor. This will give a fine visible image of veins in the image. And it can be checked with already stored images dataset of the person. If both the finger vein images are matched in the fine manner, the system will give positive result. Otherwise it gives the negative result.



Fig.1. Arduino Board.

A. Arduino Uno Board

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button is as shown in Fig.1. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

B. JPEG Color Camera - Uart Interface

It is very simple to use which is controlled through UART having color camera and having jpeg image compression on-board that can capture resolutions up to 640X480 and immediately sends snapshot command immediately to pc through USB port is as shown in Fig.2.



Fig.2. JPEG Camera.

Features:

- Low power: 3.3V, 60mA.
- 4-pin interface: Vdd, GND, TX, RX.
- 100uA current consumption in sleep mode.
- VGA resolution; built-in down-sampling to QVGA or CIF.
- TTL interface of up to 115.2kbps, auto baud detection.
- Simple, well-defined command set.
- JPEG codec for different resolutions.
- Built-in color conversion: 4 gray, 16 gray, 256 gray, 12-bit RGB, 16-bit RGB.

C. SD Card Reader/Writer

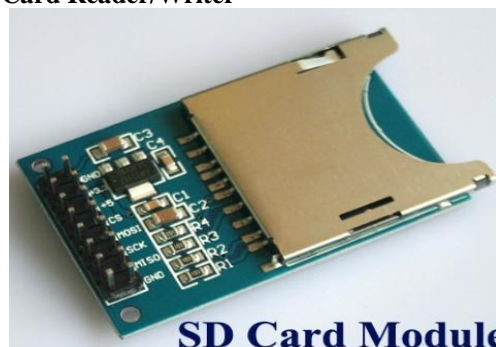


Fig.3. SD Card Module.

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The SD library allows for reading from and writing to SD cards, e.g. on the Arduino Ethernet Shield is as shown in Fig.3. The library supports FAT16 and FAT32 file systems on standard SD cards and SDHC cards. It uses short 8.3 names for files. The file names passed to the SD library functions can include paths separated by forward-slashes, /, e.g. "directory/filename.txt". Because the working directory is always the root of the SD card, a name refers to the same file whether or not it includes a leading slash (e.g. "/file.txt" is equivalent to "file.txt"). The communication between the microcontroller and the SD card uses SPI, which takes place on digital pins 11, 12, and 13 (on most Arduino boards) or 50, 51, and 52 (Arduino Mega).

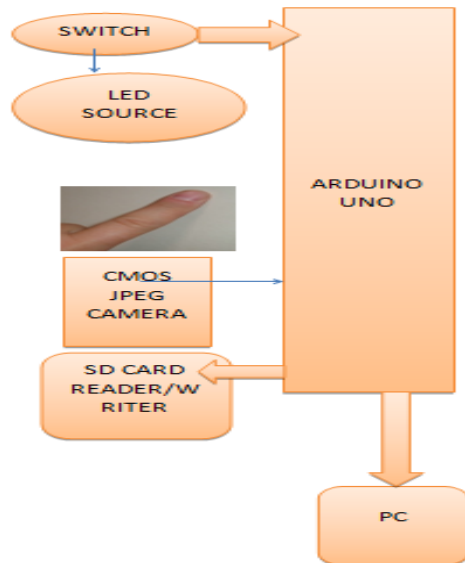


Fig.4. Block diagram of system.

IV. EXPERIMENTAL RESULTS

A. Dataset

To the best of our knowledge, is no public finger-vein image database has yet been introduced. Therefore, we constructed a finger-vein image database for evaluation,

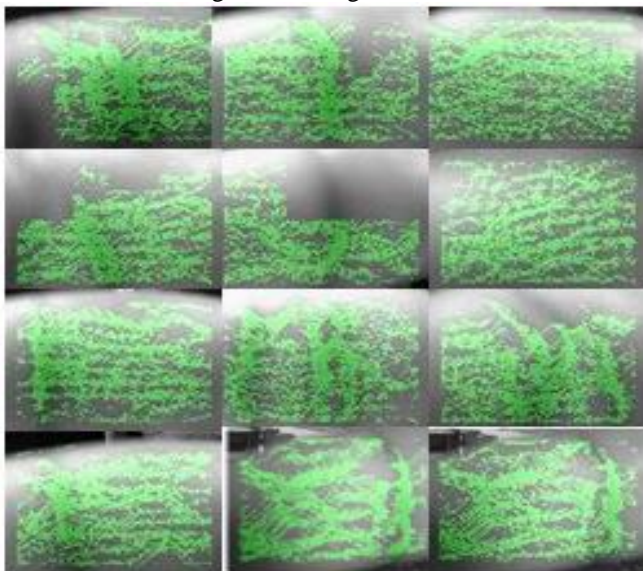


Fig.5. Finger vein images from different persons.

which contains finger-vein images from 4 subjects (75% male and 25% female) from a variety of ethnic/racial ancestries. The ages of the subjects were between 21 years old and 30 years old. Finger vein images from different persons as shown in Fig.5.

B. Performance Evaluation

The Vein geometry features are insufficient to identify individuals. This is because, the Vein geometry features such as Vein size, Vein width and others of adults are similar. The Vein line features also include principal lines, wrinkles and ridges

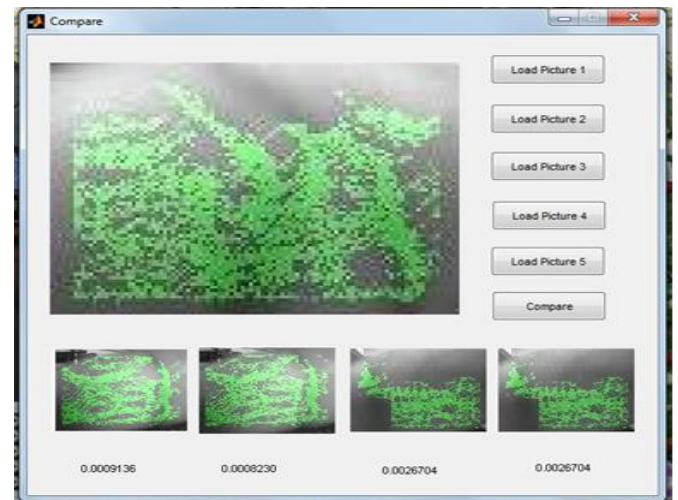


Fig.6. comparison of different fingers.

From above Fig.6 it is shown that input captured finger vein image is compared with the different fingers. The authenticated finger vein image is which image value is equal to or very near to zero value and the remaining images are non authenticated.

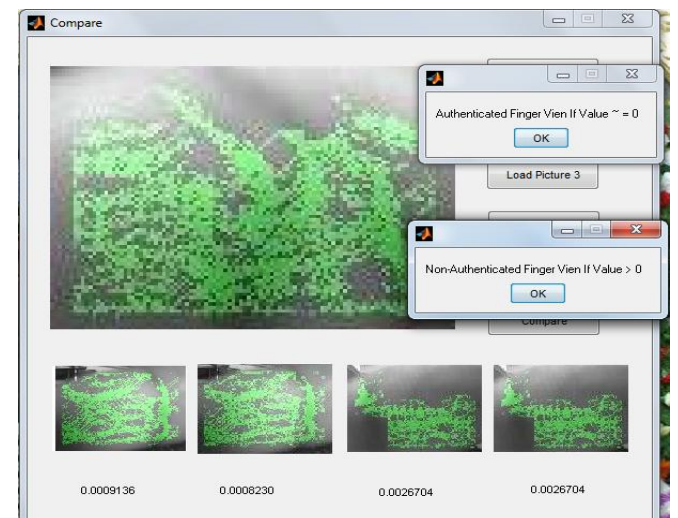


Fig.7. Result of input finger vein image.

From above Fig.7 it is shown that result of input captured finger vein image. The separation of wrinkles and principle lines are difficult since some wrinkles might be

as thick as principle lines Vein point features use the minutiae points or delta points to identify an individual. Point features require high resolution hand image because low-resolution hand image does not have a clear point's location.

V. CONCLUSION

The present study proposed an end-to-end finger-vein recognition system based on the Arduino Uno platform and vein image extraction/matching is implemented on a MATLAB application platform. Our system is suitable for mobile device because of its low computational complexity and low power consumption. As the finger-vein is a promising biometric pattern for personal identification in terms of its security and convenience. Also the vein is hidden inside the body and is mostly invisible to human eyes, so it is difficult to forge or steal. The non-invasive and contactless capture of finger-veins ensures both convenience and hygiene for the user, and is thus more acceptable.

VI. REFERENCES

- [1] David Mulyono, and Horng Shi Jinn, "A Study of Finger Vein Biometric for Personal Identification", Proceedings of the IEEE International Symposium on Biometrics and Security Technologies (ISBAST 2008), pp. 1-8, 2008.
- [2] Wenming Yang, Qing Rao, and Qingmin Liao, "Personal Identification for Single Sample using Finger Vein Location and Direction Coding", Proceedings of the IEEE International Conference on Hand-based Biometrics (ICHB), pp. 1-6, 17-18 March 2011.
- [3] Hua-Bin Wang, and Liang Tao, "Novel Algorithm for Enhancement of Hand Vein Images based on Adaptive Filtering and Retinex Method", Proceedings of the IEEE International Conference on Information Science and Technology (ICIST), Wuhan, Hubei, China, pp. 857-860, 23-25 March 2012.
- [4] Desong Wang, Jianping Li, and Gokhan Memik, "User Identification based on Finger-vein Patterns for Consumer Electronics Devices", IEEE Transactions on Consumer Electronics, Vol. 56, No. 2, pp. 799-804, May 2010.

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